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INTERRELATIONSHIP BETWEEN DIET QUALITY AND DEPRESSIVE SYMPTOMS IN ELDERLY

ABSTRACT

Background: Several observational studies have shown association between diet quality and depression, but few studies have explored the interrelationship between these variables. *Objective:* The aim of this study was to assess the interrelationship between diet quality and depressive symptoms in elderly. *Design:* Cross-sectional study. *Setting:* Population based. *Participants:* 1,378 elderly in the city of Pelotas, Brazil. *Measurements:* The diet quality was assessed by a short food frequency questionnaire and the prevalence of depressive symptoms was estimated by the abbreviated Brazilian version of the Geriatric Depression Scale (GDS). The association between diet quality and depressive symptoms was assessed using logistic regression. *Results:* The prevalence of depressive symptoms was 15.3%. Elderly with low-quality diet were more likely to experience depressive symptoms, and the association was almost twice higher in males than in females (men OR = 3.8, 95% CI 1.4, 10.6; women OR = 2.1, 95% CI: 1.4, 3.3). On the other hand, depressive elderly had higher odds of consuming a low-quality diet (OR 2.4, 95% CI: 1.7, 3.8). *Limitations:* Self-reported data and cross-sectional design limit our conclusions. *Conclusions:* The choice of a low-quality diet was associated to a higher risk of depressive symptoms in elderly, and vice-versa. These results highlight the importance of encouraging the choice of healthy food habits, especially in depressed elderly, in order to promote healthy aging.

Keywords:

Diet quality

Food habits

Depression

Cross-sectional studies

INTRODUCTION

Depression affects about 300 million people worldwide, and it is a relevant and growing public health problem (1). Besides being considered the main cause of mental deficiency all over the world, depression is currently the second main contributor for the global burden of diseases, and it is estimated that it will be the first main cause of the global burden of diseases until 2030 (2-3). Depression is a highly prevalent disease in elderly people (4), and it is associated to increased risk of morbidity and mortality and decreased quality of life and well-being in this population.

Several studies have shown an association between lifestyle and development of depression, emphasizing the modifiable behavioral risk factors (5-6), such as diet. These studies suggest that a high-quality diet is associated to a decreased risk of depression (6-8). On the other hand, it is also possible that depressed individuals change their eating behaviors due to the disease (9-10).

Although the evidence for the relationship between diet and depression has increased throughout the last few years (8), a considerable part of the studies is limited to assessing the intake of nutrients or specific food and their association with depression, or the use of supplementary food as a mechanism to prevent depression (7, 11-13). However, the effect of diet on mental health is a complex process, depending not only on the interaction among the nutrients consumed, but also on the variety of food ingested in the diet (6, 7). The studies which assess the association between diet quality and/or eating patterns and depression are predominantly carried out with adolescents (8, 14-17) and adults (6, 9, 18-19). Most of the studies carried out with elderly assess the effect of diet on the occurrence of depression (20), but not the reverse direction. Considering the aging trend of the world population due to the increase in life expectancy and decrease in fertility and mortality rates, this assessment in the elderly population plays an important role (21).

The aim of this study was to assess the interrelationship between diet quality and depressive symptoms in elderly.

METHODS

Cross-sectional, population-based study, comprising a research consortium of Masters' students (22), which aimed to assess distinct aspects of general health of the population aged 60 or more living in the urban area of the city of Pelotas, Brazil, in 2014.

The sample selection was carried out in two stages. Firstly, we selected the census sectors of the city, according to the Brazilian Institute of Geography and Economy (*Instituo Brasileiro de Geografia e Economia* -IBGE) census (23). Then, the households within each sector were systematically selected. Institutionalized elderly and those in enteral nutritional therapy were not included in the study sample.

To estimate the prevalence of depressive symptoms, we used the abbreviated Brazilian version of the Geriatric Depression Scale – GDS (24). It consists of a screening instrument with 10 yes/no questions related to the seven days prior to the interview. For each affirmative answer a point was awarded, and the results ranged from zero to ten. We considered as having depressive symptoms the elderly who had a score ≥ 5, a cut-off which has the best sensitivity and specificity for Major Depressive Disorder, according to the criteria of International Classification of Diseases (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (25).

Elderly dietary quality was assessed using a score developed for another study in the same population (26), which was called Elderly Dietary Quality Index (EDQ-I). The score awarded points ranging from 0 to 3 according to the intake frequency of 11 groups of food. The food groups considered in the study as "healthy" were rated in an increasing way (elderly who did not consume it = zero points; who consumed between 1-3 days/week= one point; who consumed between 4-6 days/week = two points, and who consumed every day in the previous before = three points). The food groups were the following: 1) rice and beans; 2) whole grain; 3) fruit; 4) vegetables; 5) milk and dairy products and 6) beef, fish, chicken or eggs. For the food items considered as "unhealthy", the score range decreased (elderly who did not consume it = three points; who consumed between 1-3 days/week = two points; who consumed between 4-6 days/week = one point, and who consumed every day in the previous week = zero points). The food items considered as unhealthy were the following: 1) sweets, soft drinks and artificial juices; 2) fried food; 3) canned food and sausages; 4) ready-to-eat and frozen food; 5) fast food. Therefore, a higher score in the EDQ-I reflected a higher consumption of healthy food and lower consumption of unhealthy food. The total score of the EDQ-I was divided into tertiles: 1st tertile (lowest score) – low quality diet; 2nd tertile – intermediate quality diet; 3rd tertile – high-quality diet.

Household interviews were conducted by interviewers with at least secondary education and who received training for data collection and anthropometric measurements. To guarantee data quality, fieldwork supervisors (Masters' students)

directly controlled several stages of the fieldwork. A short version of the questionnaire was applied to 10% of the sample, which was selected randomly.

Initially, the sample was described according to socioeconomic and demographic characteristics, and the association of the covariates with the outcomes was assessed. Then, we assessed the interrelationship between diet quality and depressive symptoms. First, depressive symptoms were considered as the outcome and its association with diet quality was assessed using logistic regression, from which crude and adjusted odds ratios were obtained. Then, diet quality was used as the outcome and its association with depressive symptoms was assessed using multinomial logistic regression, and high-quality was considered the reference category. Crude and adjusted odds ratio were obtained as well. Demographic, socioeconomic and behavioral variables were used in the adjusted analyses as potential confounders.

The demographic and socioeconomic variables assessed were: gender (male, female), age (60-69, 70-79, 80 or more), marital status (with partner, without partner), years of schooling (0, 1-3, 4-7, 8-10, 11 or more) and economic class, classified according to the Brazilian Economic Classification Criterion developed by the *Associação Brasileira de Estudos Populacionais* – ABEP (Brazilian Association of Market Research Companies) (A/B, C and D/E) (27). The behavioral variables were: current smoking status, which corresponded to use of at least one cigarette per day for more than one month (yes, no); alcoholic beverage intake in the 30 days prior to the interview (yes, no) and physical activity level, assessed by the International Physical Activity Questionnaire (IPAQ) (28), which classified as active those individuals who practiced ≥150 weekly minutes of leisure activity.

The analysis was performed using Stata 12.1 (Stata Corp, College Station, USA). The significance level adopted for the associations was 5%, and the sampling design was considered in the analysis. Analysis was stratified by gender when evidence of interaction was observed ($p<0.05$).

The study was approved by the Research Ethics Committee of Faculty of Medicine of the Federal University of Pelotas, under protocol number 472.357/2013. All participants signed an Informed Consent Form.

RESULTS

In this study, 1,844 elderlies were eligible and 1,451 were interviewed, corresponding to 9.7% of loss and 11.6% of refusals. Complete information on the outcomes was available for 1,378 individuals, which constitute the sample for this study. The demographic, socioeconomic, behavioral and health-related characteristics of the elderly are described in Table 1. The majority of the elderly was female (63.1%), aged 60 to 69 years (53.1%), belonged to the economic class C (52.8%) and studied up to 7 years (67.9%). With regard to marital status, the majority of the elderly lived with a partner (53.4%), and this proportion was lower in the older groups. About 80% of the elderly practiced insufficient leisure physical activity, 21.8% reported alcoholic beverage intake in the 30 days prior to the interview, and 12.9% were current smokers.

The prevalence of depressive symptoms was 15.3%, and it was higher in females, individuals without a partner, from lower economic classes, with lower schooling, who reported alcoholic beverage intake and who practiced insufficient leisure physical activity (Table 2). The EDQ-I ranged from 11 to 33, with average 24.2 (SD=3.8) and median 24.0 (data not showed in table). The prevalence of low quality diet was higher in males, from lower economic classes, with lower schooling, and individuals who smoked, reported alcoholic beverage intake and did not practice sufficient leisure physical activity (Table 2).

The association between dietary quality and depressive symptoms is shown in Table 3. In crude analysis, those elderly who consumed a low-quality diet had a higher odds of depressive symptoms than those who consumed a high-quality diet. This association was still evident after adjustment for confounders, and it was stronger for males (OR 3.78, 95% CI: 1.35, 10.57) than for females (OR 2.13, 95% CI: 1.35, 3.33). The odds of depressive symptoms was higher according the lower diet quality for both genders (Table 3).

Crude and adjusted analyses of the association between depressive symptoms and dietary quality are presented in Table 4. After adjustment for confounders, those elderly who had depressive symptoms had higher odds of adhering a low-quality diet than those who had no depressive symptoms (OR 2.43, 95% CI: 1.59, 3.71). No association was observed for intermediate quality diet (OR 1.40, 95% CI: 0.91, 2.16).

DISCUSSION

This study showed an interrelationship between diet quality and depressive symptoms in elderly. A low-quality diet was associated with a higher odds of depressive symptoms, and this association was stronger for males than females. At the same time, depressed elderly had a higher odds of adopting a low-quality diet, and this association was similar across genders.

Both depression and low-quality diet have been independently associated to a higher risk of morbidity and mortality, as well as a decreased quality of life. An emerging body of evidence has suggested that nutrition plays an important role in mental health (29), showing that unhealthy diets are associated to higher levels of depression in many populations (9, 30-32). In line with this evidence, we observed in our study that the choice of a low-quality diet, characterized by a low consumption of healthy food and a high consumption of unhealthy food, was associated to a higher odds of depression in elderly. Other studies carried out in elderly, although using different methodologies, have found similar results (20, 33). A recent meta-analysis showed that elderly who adopted more to a healthy pattern, characterized by a high consumption of vegetables, fruit, whole grains and fish, had a lower risk of depression (7). However, the authors did not find any association between the choice of a Western diet pattern and depression, and they attribute this lack of association to a small number of studies and to low statistical power (7).

A possible explanation for the association between diet quality and depression is that diet modulates physiological factors which play a part in depression, such as inflammatory and oxidative processes, plasticity and cerebral function, as well as the stress response system, and, consequently, could contribute in the development of depression (10). Some studies have shown that the consumption of a diet rich in antioxidants, vitamins, minerals and fibers is associated with lower systemic inflammation (34), whilst Western diet (35-36) or diets with low quantity of essential nutrients, like magnesium (37-38), are associated with higher systemic inflammation. On the other hand, inflammation leads to increased oxidative stress, which is pointed as a risk factor for depression (39).

Our study showed that depressive symptoms can lead to a poorer dietary intake, which was also observed in other studies (10, 32). Few studies have assessed the role of depression on dietary intake or quality in elderly, and some of them have suggested that depressed individuals are more likely to consume a higher quantity of sugar- and fat-rich food intending to attenuate anguish feeling (9, 40). However, they also consume a lower

quantity of fruit and vegetables (41), which could result in a lower diet quality. A case-control study carried out by Payne et al (2012) showed that depressed elderly consumed less fruit, vegetables and antioxidants than non-depressed (41). The association of depression with poorer diets could be due to the appetite modification frequently occurred after the disease development. Modification of appetite is a common symptom among those diagnosed with major depression, and it is one of the diagnostic criteria of depression in DSM-V (9-10).

STRENGTHS AND LIMITATIONS:

The cross-sectional design of this study does not allow the establishment of a causal relationship in the association between diet quality and depressive symptoms, thus some caution is needed in the interpretation of the results. In addition, although the analysis has been adjusted for potential confounders, it is possible that both depression and diet may be influenced by another factor not measured in this study, then we cannot rule out residual confounding.

The short food frequency questionnaire (FFQ) used in this study might not have captured all the food components of the eating habits of the elderly. However, the main objective of the FFQ was to differentiate the dietary quality among those depressed and not depressed instead of providing accurate measure of the dietary consumption. Still, the usage of a short FFQ in research has advantages in relation to longer versions, once it facilitates its applicability and has a better adherence from the interviewees (42). Other possible limitation is the use of a screening instrument, which captures depressive symptoms instead of diagnose of depression.

The methodological quality of the study, which enabled the use of a random and representative sample of the elderly of the city of Pelotas is a positive aspect which has to be highlighted. Moreover, the assessment of the interrelationship between diet and depressive symptoms contributes with the body of evidence in this field, encouraging future longitudinal studies investigating this association.

CONCLUSION:

This study suggests an interrelationship between diet quality and depressive symptoms in the elderly. Considering this, the encouragement of a healthy eating as a way to promote healthy aging is important, as so the need of nutritional attention in depressed individuals due to the higher risk of having a low-quality diet. Longitudinal

studies addressing the interrelationship between diet and depression in the elderly should be carried out to better understand the possible bidirectionality of this association and to explore whether the effect is punctual or remains in the long term. Moreover, exploration on the mediators of this relationship, like nutritional biomarkers, could help to understand the possible mechanisms through which diet could result in a poorer mental health and to elucidate forms of interventions.

COLLABORATIONS:

APG participated in all stages of the study, including the proposal of the research question, the data analysis and manuscript writing. IOB and ALGS participated in the manuscript writing and reviewed the final draft. NH, ET, MCA and HG reviewed all the drafts of the manuscript and contributed with suggestions to the work.

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Table 1. Demographic, socioeconomic, behavioral and health-related characteristics of the elderly. Pelotas, Brazil, 2014 (N=1,378)

Variables	N	%
Gender		
Male	508	36.9
Female	870	63.1
Age (years)		
60 – 69	731	53.1
70 – 79	438	31.8
80 or more	207	15.1
Marital status		
Without partner	642	46.6
With partner	735	53.4
Economic class (ABEP)*		
A/B	457	34.8
C	694	52.8
D/E	163	12.4
Schooling (years)		
0	183	13.4
1 – 3	319	23.3
4 – 7	427	31.2
8 – 11	138	10.1
12 or more	301	22.0
Current smoking		
No	1,199	87.1
Yes	178	12.9
Alcohol intake in the previous 30 days		
No	1,075	78.2
Yes	300	21.8
Leisure physical activity (IPAQ)		
Active	247	18.4
Insufficiently active	1,093	81.6

ABEP: *Associação Brasileira de Estudos Populacionais* (Brazilian Association of Market Research Companies), IPAQ: International Physical Activity Questionnaire.

*Higher number of *missing:* 64

Table 2. Depressive symptoms and diet quality according to demographic, socioeconomic, behavioral and health-related characteristics of the elderly. Pelotas, Brazil, 2014 (N=1,378)

Variables	Depressive symptoms Total: 211 (15.3%) n (%)	p-value	Low diet quality Mean (SP): 19.9 (1.85) n (%)	Intermediate diet quality Mean (SP): 24.5 (1.14) n (%)	High diet quality Mean (SP): 28.7 (1.61) n (%)	p-value
Gender		<0.001				<0.001
Male	50 (9.8)		210 (41.3)	180 (35.4)	118 (23.2)	
Female	161 (18.5)		255 (29.3)	342 (39.3)	273 (31.4)	
Age (years)		0.602				0.018
60 – 69	114 (15.6)		250 (34.2)	299 (40.9)	182 (24.9)	
70 – 79	70 (16.0)		146 (33.3)	158 (36.1)	134 (30.6)	
80 or more	27 (13.0)		69 (33.3)	65 (31.4)	73 (35.3)	
Marital status		<0.001				0.672
Without partner	122 (19.0)		210 (32.7)	244 (38.0)	188 (29.3)	
With partner	89 (12.1)		255 (34.7)	278 (37.8)	202 (27.5)	
Economic class (ABEP)*		<0.001				<0.001
A/B (Highest)	50 (10.9)		116 (25.4)	188 (41.1)	153 (33.5)	
C	108 (15.6)		259 (37.3)	253 (36.5)	182 (26.2)	
D/E	41 (25.2)		74 (45.4)	56 (34.4)	33 (20.3)	
Schooling (years)		0.006				0.002
0	32 (17.5)		75 (41.0)	65 (35.5)	43 (23.5)	
1 – 3	61 (19.1)		118 (37.0)	119 (37.3)	82 (25.7)	
4 – 7	72 (16.9)		150 (35.1)	162 (37.9)	115 (26.9)	
8 – 11	19 (13.8)		49 (35.5)	52 (37.7)	37 (26.8)	
12 or more	27 (9.0)		70 (23.3)	121 (40.2)	110 (36.5)	
Current smoking		0.085				<0.001

Variables	Depressive symptoms Total: 211 (15.3%) n (%)	p-value	Low diet quality Mean (SP): 19.9 (1.85) n (%)	Intermediate diet quality Mean (SP): 24.5 (1.14) n (%)	High diet quality Mean (SP): 28.7 (1.61) n (%)	p-value
No	176 (14.7)		371 (30.9)	464 (38.7)	364 (30.4)	
Yes	35 (19.7)		94 (52.8)	58 (32.6)	26 (14.6)	
Alcohol intake in the previous 30 days		0.002				<0.001
No	182 (16.9)		337 (31.4)	413 (38.4)	325 (30.2)	
Yes	29 (9.7)		127 (42.3)	108 (36.0)	65 (21.7)	
Leisure physical activity (IPAQ)		<0.001				0.016
Active	13 (5.3)		67 (27.1)	95 (38.5)	85 (34.4)	
Insufficiently active	189 (17.3)		384 (35.2)	419 (38.3)	290 (26.5)	

ABEP: *Associação Brasileira de Estudos Populacionais* (Brazilian Association of Market Research Companies), IPAQ: International Physical Activity Questionnaire.

Table 3. Crude and adjusted analysis of the association between dietary quality and depressive symptoms. Pelotas, Brazil, 2014 (N=1,378).

Dietary quality	Male		Female	
	OR Depressive Symptoms (95% CI)	p-value*	OR Depressive symptoms (95% CI)	p-value*
Crude		0.001		<0.001
Low	4.07 (1.54; 10.70)		2.59 (1.64; 4.10)	
Intermediate	1.76 (0.61; 5.07)		1.58 (1.00; 2.49)	
High	1.00		1.00	
Adjusted [a]		0.003		0.001
Low	3.78 (1.35; 10.57)		2.13 (1.35; 3.33)	
Intermediate	1.55 (0.44; 5.49)		1.39 (0.85; 2.26)	
High	1.00		1.00	

[a] Adjusted for gender, age, marital status, education, economic class, leisure physical activity, current smoking, and alcohol intake in the previous 30 days.

Table 4. Adjusted analysis between depressive symptoms and dietary quality in elderly. Pelotas, 2014 (N=1,378).

Depressive symptoms	Dietary quality (EDQ-I)				
	Low		Intermediate		High
	Crude OR (95% CI)	Adjusted OR [a] (95% CI)	Crude OR (95% CI)	Adjusted OR [a] (95% CI)	Reference category
No	1.00	1.00	1.00	1.00	1.00
Yes	2.51 (1.68; 3.75)	2.43 (1.59; 3.71)	1.53 (1.01; 2.32)	1.40 (0.91; 2.16)	1.00

[a] Adjusted for gender, age, marital status, education, economic class, leisure physical activity, current smoking, and alcohol intake in the previous 30 days